

UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	P99,1523
	First Named Inventor or Application Identifier	
	Heiko Holzheuer	
	Express Mail Label No:	

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

- ☒ Specification [Total Pages 16]
☒ Drawing(s) (35USC 113) [Total Pages 1]
☒ Declaration and Power of Attorney [Total Pages 2]

a. ☐ Newly executed declaration (Original copy)

b. ☐ Copy from prior application (37CFR 1.63(d))
(for continuation/divisional with Box 14 completed)

- [Note Box 4 Below]
i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting
Inventor(s) named in the prior application,
see 37 CFR 1.63(d)(2) and 1.33(b).

Incorporation By Reference (usable if Box 3b is checked)
The entire disclosure of the prior application, from which a
copy of the oath or declaration is supplied under Box 3b,
is considered as being part of the disclosure of the
accompanying application and is hereby incorporated by
reference therein.

ACCOMPANYING APPLICATION PARTS

5. ☐ Assignment Papers (cover sheet & documentation)
6. ☒ Letter under 37 CFR 1.41(c).
7. ☐ English Translation Document (if applicable)
8. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
9. ☐ Preliminary Amendment
10. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
11. ☐ Small Entity ☐ Statement filed in prior application,
Statement(s) Status still proper and desired
(Faxed copy of original)
12. ☒ Certified Copy of Priority Document(s) German
Application No. 199 10 357.7 filed March 9, 1999
13. ☐ Other:

14. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

Continuation ☐ Divisional ☐ Continuation-in-part (CIP) ☐ of prior application No: 1

CLAIMS AS FILED

(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) BASIC FEE \$760 00
TOTAL CLAIMS 20	17			
INDEPENDENT CLAIMS 3	2			
ANY MULTIPLE DEPENDENT CLAIMS? (YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>				
			TOTAL FILING FEE ->	\$760 00

☒ The Commissioner is hereby authorized to charge any additional fees which may be required in connection with this application, or credit any overpayment to ACCOUNT NO. 08-2290. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of \$ 760.00 to cover the filing fee is enclosed.

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DATE: August 5, 1999

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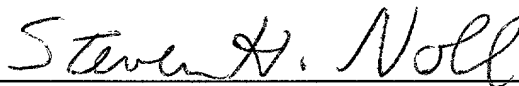
Assistant Commissioner for Patents,
Washington, D.C. 20231

RE: Proposed Patent Application for **HEIKO HOLZHEUER** entitled:
**"SEARCH AND NAVIGATION DEVICE FOR HYPERTEXT
DOCUMENTS"**
based on German patent application: **199 10 357.7**
filed **09 MARCH 1999**
Attorney Docket No. **P99,1523**

Sir:

Under the provisions of 37 CFR 1.41 (c), I am filing the attached application with
17 Claims, 1 sheet of informal drawings, **un-executed Declaration, Priority Document**
and **filing fee** on behalf of **Heiko Holzheuer** and request that the application be assigned
a serial number and filing date, pursuant to the provisions of 37 CFR 1.53 (b) and 1.53 (d).

Respectfully submitted,



Steven H. Noll
Attorney for Applicant

(Reg. No. 28,982)

SPECIFICATION

TITLE

“SEARCH AND NAVIGATION DEVICE FOR HYPERTEXT DOCUMENTS”

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to navigation and searching in documents which are connected by links and are most commonly referred to as hypertext documents.

Description of the Prior Art

Documents connected by links are usually referred to as hypertext documents. One example of a hypertext document format that is commonplace and widely used on the Internet is the hypertext markup language (HTML) format. Another example of a hypertext document format is that used by the help files contained in the graphical user interface "WINDOWS" sold by the Microsoft Corporation. The term "HTML pages" used below should be construed as encompassing all forms of hypertext documents.

Although searching for information by navigating through the hyperlinks of hypertext documents represents a vast improvement over searching through traditional documents with their hierarchical chapter structure, additional aids to searching and navigating are necessary. These aids include an index which links the search words to their corresponding pages.

Other known aids include "search engines". These are queried using one or more relevant words which are applied to a precompiled and continuously updated index which is usually very comprehensive but not directly visible. The

search engines then display links to a number of documents in which these relevant words are mentioned.

A number of options are available for compiling this index from HTML documents. The index may be compiled from: 1) relevant words using the META tag, 2) text contents of other tags, in particular, the "TITLE" tag, or 3) the contents of the entire text. The option chosen depends primarily upon the amount of data to be indexed in relation to the operating resources available.

For search engines, the correct choice of search words is of crucial importance for a good search result, but search engines do not take into account nor represent the relationship of relevant documents. Thus, during a search, an individual may find a hypertext page that is reasonably close to containing the desired information, yet that individual will then have to systematically search back and forth through the links and manually inspect the hypertext pages in order to find the desired information.

A tree is used to represent the basic structure of hypertext pages because each page appears as nodes with links to subordinate nodes, although back links and cross links critically interfere with this structure. One navigation aid, known as a site map, displays a structure tree of the hypertext documents. The site map starts with a reference page, which is usually referred to as the home page, and constructs tree roots--the site map suppressing (or displaying as unhighlighted) all links conflicting with the tree structure. A number of other two-dimensional graphical representation forms are known, and, more recently, three-dimensional images have been utilized, which the user can interactively rotate and project onto a two-dimensional display surface. Yet a disadvantage

with these representations is that they are only labeled with a short text string, usually the defined title. Although this navigation is clearer than if the user constructs this tree in his memory or writes it down on paper, the user nevertheless still has no help as to which of the nodes might have the greatest
5 relevance. Furthermore, the usefulness of a search engine and associated index is contingent on the appropriate choice of relevant words to be searched.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a device which, starting from a known hypertext document, automatically displays other related
10 documents without the user having to extract search words from the content of the starting document in order to initiate an index or full-text search. The above object is achieved in accordance with the invention in an apparatus and method wherein a symbolic representation of a starting document and of the documents connected to it, along with the degree of similarities of the linked documents are
15 displayed.

BRIEF DESCRIPTION OF THE DRAWING

The features of the present invention which are believed to be novel, are set forth with particularity in the appended claims. The invention, together with further objects and advantages, may best be understood by reference to the
20 following description taken in conjunction with the accompanying drawing, and in which:

Figure 1 is a diagram showing the image displayed by the device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the preferred embodiment, the device consists of a computer with a graphical display and known input units such as mouse and keyboard. The graphical display is preferably run with the program packages X/Windows, JAVA, an operating system ending in "IX", etc. It is also possible to use Microsoft Corporation's Windows-based operating systems.

A hypertext document containing hypertext links (links), preferably stored in HTML format, is shown on the graphical display, using a program called a browser which utilizes the HTML format instructions for presentation. An extra function, beyond those of the browser, is provided to the user through a JAVA application or other separate program written in a suitable program language. This function or program takes an address, or URL, of the starting document as a parameter, and uses the links contained within the starting document to access other documents referenced by those links. This procedure is then recursively repeated for these other documents.

Since the link structures of hypertext documents do not necessarily represent a tree, a restriction of the search level is necessary. This may be done by specifying: 1) the number of recursion levels to be used, 2) the number of documents to be searched, 3) the amount of time used, 4) a scope limitation on the domains or addresses searched, or 5) a combination of the preceding.

Figure 1 shows an essentially tree-like representation, as could be found as the result of a recursive downward path in four planes, including the starting document A1 according to the prior art. The documents are represented as circles and the links as arrows. The shading of some circles constitutes a part

of the invention that is not present in the prior art. As can be seen, document A1 contains two links to documents B1 and B2; B1 links to C1, C2, C3 and D4; B2 links to C3 and C4; C1 links to D1, D2 and D3; C2 links to D3, D4 and D5; C3 links to D5 and D6; and C4 to D7 and D8.

5 Since the documents need to be loaded into the device in order to determine the links contained in them, processing is carried out for each newly loaded document. To process these documents, the words in the document are extracted and assessed in terms of their frequency, ignoring irrelevant word types such as articles, conjunctions, and other stop words; the processing also
10 may utilize some form of a dictionary to implement only basic forms of words for heavily inflected languages.

 A basic frequency assessment simply approximates the number of word occurrences in the document. An improved variant may also account for the position of each word occurrence; for example, words in the title or the list of relevant words may be assessed with a higher weight so that the frequency
15 appears as a fraction. Normalization to the total number is also possible. These frequencies may be arranged in a matrix which grows with the number of documents investigated, where the rows are the documents indexed and the columns are the words indexed.

20 Using this matrix, a distance between two documents can be determined by multiplying two column vectors and taking the sum of the products. The greater this distance between two documents is, the more similar the two documents are; this distance is particularly large if the documents have many common words which also occur with similar frequencies in both documents.

The first proposals in this direction were made by H. Luhn in the article "The Automatic Creation of Literature Abstracts", IBM Journal of Research and Development 2, 158-165, 1958. Other functions which use the matrix or extract a square symmetric matrix of the distance of the documents from one another from the matrix, by determining distances in pairs and thereby eliminating the words, are likewise possible. The choice of functions may be made on pragmatic grounds and is unimportant to the basic functionality of the invention, even though success in applying it may depend on the functions used. The distance measure does not correspond to the criteria of a topological distance, since the triangle inequality need not be satisfied and the distance from one document to itself gives a maximum value instead of zero.

The use of word frequency vectors is advantageous to the extent that the matrix of the weighted word frequencies can be made dynamically during the recursive searching, and each document needs to be transmitted and analyzed only once. This does not, however, preclude the possibility of running the device in such a way that a distance measure is re-determined each time by currently loading and evaluating the relevant documents. It is also possible to have a combination in which the determination via word frequencies determines a preselection of documents for which the distance measure is then accurately determined in pairs using other methods, which require the document text itself. As mentioned above, this could be the case with heavily inflected languages or the like, in which the procedure of reduction to word stems requires an elaborate syntax and semantic analysis.

The link structure is preferably displayed after the search procedure has

been completed and the matrix has been compiled. A large number of forms are known for displaying the link structure, such as a list of entries, a tree-like graphical representation or elaborate 3D/2D representations. In all customary representation forms, the foreground contains a tree structure as is canonically created in a recursive downward path. The links not corresponding to the tree structure are then either not shown or are represented as extra lines, where appropriate in unhighlighted form. As 3D/2D representation, various formats are known in which the structure is first built up as a graphic in a three-dimensional space and then projected onto a two-dimensional surface, such as a fisheye view.

Figure 1 shows one such greatly simplified representation, in which color is represented by shading. Document A1 is the starting document and is specially labeled here by a double border. Since this is also the starting point of the document similarities, it has the same shading as the two documents D3 and C3 most similar to it. The two next most similar documents B1 and D2 are represented as dotted.

Regardless of the representation used, the invention relates to the fact that the distance from the starting document, determined through the matrix or in a different way, is displayed by the symbols in the structure representation. Color is preferably used because it does not have any essential role in known representations. For example, the following colors could be used to represent the greatest to the least degree of similarity respectively: red, green, yellow, blue, and black. Gray scales represent another type of coloring that could be used with a display having a light background: white might be preferably used

to denote low significance and black to denote the greatest similarity.

A symbol size might likewise be equivalent to a color for representing degree of similarity; for this reason, "color" in the claims is also intended to cover gray scales as well as other scalable representations such as the diameter of a circular surface. Size is not useable as a "color" only in the case of 3D/2D representations, in which it is desired to have a perspective reduction through the projection in order to view the position in space. It is further possible to use shape as a "color" because a triangle is a substantially more significant representation and clearly distinct from a square (although the difference between a hexagon and a heptagon may be hard to see). Nevertheless, the number of vertices could also represent a "color"; this could be important for users with reduced visual capacity in the area of chromatic colors who may be better able to discriminate shapes. The use of shapes may also be combined with a chromatic color representation.

If the distances and colors of the symbols are defined, then one could give special emphasis to the document closest to the starting document. One might utilize a fully or partially flashing symbol, such as a flashing yellow circumference where the symbols are circular surfaces and a dark color signals greater similarity than a light color.

Since the symbols all appear on the interface, it is also possible for a symbol which is not yet the starting document to be made the new starting document using an input instrument (e.g., a mouse). In the preferred embodiment with data already accumulated in matrices, the new coloring of the representation can then rapidly be determined and displayed. Preferably, in this

case, a new downward path from the new position is not run through, and the data already accumulated are used instead. In the case of corresponding operating means, however, it is expedient to add the documents which are still missing and have been moved into range by the new reference point; this may, if appropriate, be done as a background process which then brings the display to the possibly altered state on request.

Since the words are still available as lists in the embodiment described above (the matrix representation of words and documents), the words are still available as lists and the user may be provided with these as a further selection criteria. Alphabetic sorting or sorting on the basis of frequency is possible as well. If the user selects one or more words, then the document giving the best match to the selection becomes the starting document. Functionally, a virtual document which comprises the maximum word frequencies of the selected words then becomes the starting document.

Unlike an indexed search, the above procedure does not cause an altered graphical arrangement of the displayed structure, but merely changes its coloring. Another embodiment also uses, preferably in addition to color, the distance of the symbols from one another in 3D-space as a "color feature". 3D representations, in particular, still leave considerable latitude in the relative distance of the symbols from one another. However, since the measures used do not, as mentioned above, represent a metric, such an image is not uniquely defined. Through an iterative procedure, however, it is possible to bring about a deformation which clearly displays the relative proximity of various documents. The fact that the display is not static, but instead continuously changes slightly because of the conflicting effects, can be tolerated here.

I CLAIM AS MY INVENTION:

1. A device for navigating documents connected by links comprising:
a computer which comprises a graphical display, an input device, and a processor;

said computer operating according to a graphical display program which generates images on said graphical display; and

said computer operating according to a navigation program which identifies a measure of similarity of a starting document to a plurality of other documents and that utilizes said graphical display program to produce and display respective symbols of said other documents related to said starting document, said graphical display program also producing respective characteristics given to said respective symbols indicating a degree of similarity of said other documents to said starting document according to said measure of similarity.

2. The device of claim 1 further comprising a storage area which holds characteristic vectors, each extracted from respective said documents, said characteristic vectors being utilized in calculations to produce said measure of similarity without referring back to respective said documents.

3. The device of claim 2 wherein said storage area holds a quantity of said characteristic vectors, wherein said quantity and selection of said documents is determined both by predefined limiting criteria and by tracing said links within said documents.

4. The device of claim 1 wherein said measure of similarity is determined by a weighted function over the frequencies of words in common in said documents to be compared.

5. The device of claim 1 wherein said symbol configurations represent said degree of similarity.

6. The device of claim 5 wherein said symbol configurations utilize color to represent said degree of similarity.

7. The device of claim 5 wherein the relative arrangement of said symbols is modified such that the distance between any said symbol representing any said other document and said symbol representing said starting document is inversely related to said measure of similarity.

8. The device of claim 1 wherein said input device is utilized by an individual to select said symbol which determines said starting document.

9. The device of claim 1 wherein said input device is utilized by an individual to generate a selection of words wherein said starting document is determined by a maximum frequency of said selection of words within said documents.

10. A method of displaying documents connected by links on a computer device comprising a graphical display, an input device, and a processor, wherein said documents are represented on said graphical display by respective symbols and symbol characteristics, comprising the steps of:

choosing one document from a universe of documents as a starting document;

determining an operative group of said documents based on said starting document;

calculating a measure of similarity between said starting document and each remaining document from said operative group; and

displaying respective symbols and symbol characteristics of each remaining document from said operative group, said symbol characteristics indicating a degree of similarity based on said measure of similarity.

11. The method of claim 10 wherein said step of calculating said measure of similarity is comprised of the steps of:

generating characteristic vectors from each of said documents;

storing said characteristic vectors in a storage area in said computer device; and

utilizing said characteristic vectors in calculating said measure of similarity without referring back to respective said documents.

12. The method of claim 10 wherein said step of determining said operative group of documents is comprised of the steps of:

tracing said links within said starting document to find and acquire newly found documents; and

iteratively tracing said links within said newly found documents to find and acquire additional newly found documents according to a predefined limiting criteria.

13. The method of claim 10 wherein said measure of similarity is determined by a weighted function over the frequencies of words in common between said starting document and said remaining documents within said operative group.

14. The method of claim 10 wherein said step of displaying respective symbols and symbol characteristics comprises the steps of:

choosing a color to represent said degree of similarity; and

displaying said symbols in the chosen color.

15. The method of claim 10 wherein said step of displaying respective symbols and symbol characteristics comprises the steps of:

calculating a physical display location at a distance away from said symbol of said starting document which is inversely related to said measure of similarity for each said remaining document in said operative group; and

displaying each said remaining document in said operative group at said calculated physical display location.

16. The method of claim 10 wherein said starting document is determined by selecting one of said symbols by an individual with said input device from a previously determined operative group.

17. The method of claim 10 wherein said starting document is determined by the steps of:

generating a selection of words by an individual with said input device from a previously determined operative group; and

determining a starting document from a previously determined operative group based on a calculation of a maximum frequency of said selection of words within a document within said operative group.

ABSTRACT OF THE DISCLOSURE

A device and method for searching or navigating in documents which are connected by links displays symbolic representations of these documents on an output unit, where a starting document is used as a reference and other documents are given a marker indicating the degree of similarity to the starting document according to a measure of similarity.

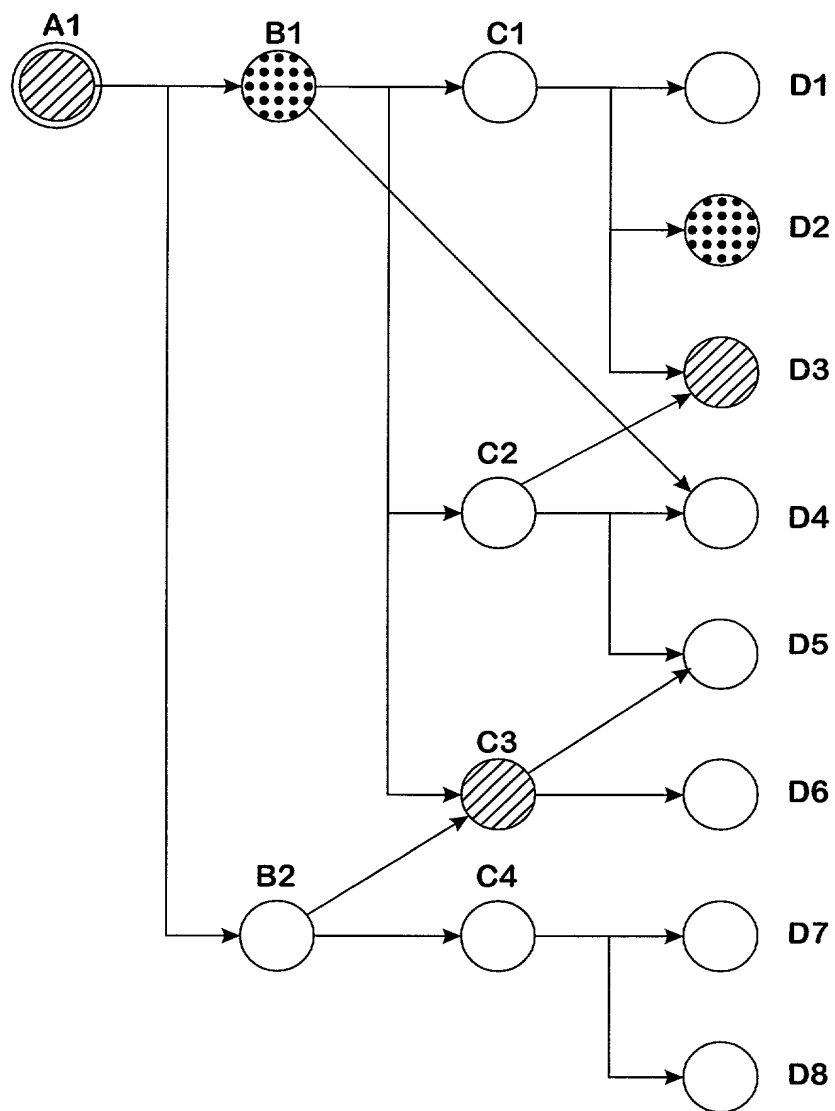


Fig. 1

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"SEARCH AND NAVIGATION DEVICE FOR HYPERTEXT DOCUMENTS"

Case No. P99,1523, the specification of which

(check one) ☒ is attached hereto.
☐ was filed on _____, as
Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent Office all information which is known to me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, 1.56(a).¹

I do not know and do not believe this invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and I believe that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as identified below:

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below

Prior Foreign Application(s)

Number

Country

Date

19910357.7

Fed. Rep of Germany

March 9, 1999

and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the above listed application on which priority is claimed:

Prior Foreign Application(s)

Number

Country

Date

¹ (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a *prima facie* case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A *prima facie* case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

If no priority is claimed, I have identified all foreign patent applications filed prior to this application:
Prior Foreign Application(s)

Number

Country

Date

And I hereby appoint Messrs. John D. Simpson (Registration No. 19,842), Dennis A. Gross (24,410), Robert M. Barrett, (30,142), Steven H. Noll (28,982), Kevin W. Guynn (29,927), Robert M. Ward (26,517), Brett A. Valiquet (27,841), Edward A. Lehman (22,312), David R. Metzger (32,919), Todd S. Parkhurst (26,494), James D. Hobart (24,149), Melvin A. Robinson (31,870), John R. Garrett (27,888), Paula J. Kelly (37,624), Joseph P. Reagen (35,332), Michael R. Hull (35,902), Michael S. Leonard (37,557), William E. Vaughan (39,056), and Lewis T. Steadman (17,074), all members of the firm of Hill & Simpson, A Professional Corporation

Telephone: 312/876-0200 Ext. 3491

my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and direct that all correspondence be forwarded to:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Citizenship _____

Post Office Address _____

Full name of third joint inventor,
(if any) _____

Inventor's signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____